WISENMESHNET® Smart Gateway

User Manual

Wisen Innovation Ltd

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Revision History and Clarification

Rev.	Issue Date	Revisions	Written By	Revised By
V5.0	20/06/2014	1st Issue	Tony Shi	Yan Wu
V6.0	28/07/2014	2nd Issue	Yan Wu	Brian Jones
V7.0	03/08/2014	3rd Issue	Yan Wu	Ian Wassell
V8.0	06/08/2014	4th Issue	Yan Wu	Ian Wassell
V9.0	17/09/2015	5th Issue: New Gateway Layout Figure Added in the appendix.	Jun Zhang	Yan Wu

Document Definition:

It defines the specifications (introduction, deployment and maintenance method) of WISENMESHNET® Smart Gateway, which is one of the key components in WISENMESHNET® Low Power, Intelligent, Wireless Sensor Network Monitoring system.

Scope:

Customer Site Project Managers and Engineers, Wisen Services Engineers.

Notice :

This documentation provides the basic instructions about the WISENMESHNET® Smart Gateway. Any further information can be requested by the customers.

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1. Product Introduction

The WISENMESHNET® Smart Gateway is one of the key products in our patented WISENMESHNET® geotechnical safety monitoring system. Working together with the WISENMESHNET® Node products and our customers Vibrating Wire (VW) type sensors, it intelligently collects, converts and delivers the real-time information on the deformation of a structure to a remote server via its embedded GPRS module. The WISENMESHNET® Smart Gateway is powered with:

A.   a 100–240VAC as main power supply;

B.   or/and a 9-12VDC power supply;

In addition, it has a rechargeable UPS to provide extra 7 days (minimum) mesh life to support data collection when both the AC mains and DC alternative power supplies are cut off. This product operates using our core technology, i.e., WISENMESHNET® Low Power, Intelligent, Wireless Sensor Network protocol. This product satisfies the three fundamental identities of the system:
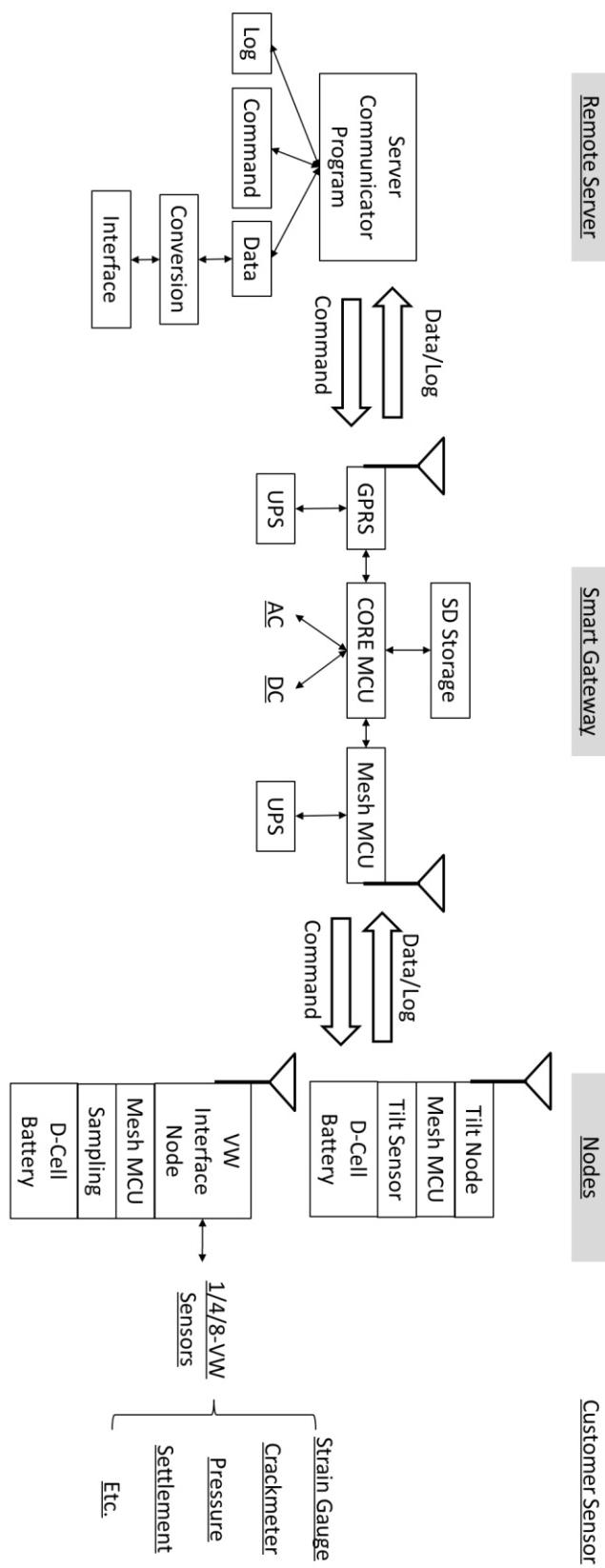
A.   Network Life Span: to maximise battery life across the mesh network as a whole;

B.   Network Data Arrival Rate: to minimise data packet loss;

C.   Single Node Environmental Coverage: to maximise radio coverage.

Our product has IP66 and CE marking and is designed to work in a tough environment. It is small in size, reliable in performance, easy for maintenance, has high precision during sampling, and has strong immunity to radio-interference.

Figure 1. Smart Gateway Overview in Photos.

2. System Structure Layout

3. Features

WISENMESHNET® Smart Gateway @ Typ. 25℃			
	Basics	Main Power Supply	100V ~ 240V(AC)
		Alternative Power Supply	9V – 12V(DC)，typ. 9V(DC)
		Working Current	Max. 2Amp@DC Power@GPRS Registration (Typ.)
		Operating Temperature	-40℃ ~ 80℃
		Storage	8GB
	Main	Backhaul Wireless Interface	GPRS (850/900/1800/1900MHz)@9600 bps
		Mesh Interface	WISENMESHNET®Protocol@250kbps
		L x W x H	180 x 140 x 60mm
		Weight	1.5kg
		IP Rating	IP66
		Cable Gland	AC Power IN - EMC-CMA14
			DC Power IN - EMC-CMA12
		Wire Connection	AC IN – Green WAGO Internal Terminal Plugs
			DC/SO IN –Grey WAGO Internal Terminal Plugs
		Fixing Bracket	Din Rail (Qty. x 2)
	Sensor	Measurement Range	-40℃ ~ 80℃
		Resolution	0.5℃
		Accuracy	±1℃
	Radio Parameter	Antenna-2.4GHz	Omni-directional 5dBi (20cm) or Customised
		Antenna-GPRS	Omni-directional 3.5dBi (20cm) or Customised
		Antenna Connect	SMA （Female）
		Protocol	WISENMESHNET® Protocol / 802.15.4 Compatible
		Frequency Band	2.405GHz ~ 2.480GHz (16 Channels)
		Transmit Power	< 1.5dBm / 20dBm (Customised)
		Receive Sensitivity	-103dBm / -108dBm (Customised)

| **WISENMESHNET® - The 3 Fundamental Identities**	
Network Life Span	>= 36 months @ Tx power = ~ 0dBm (typical, 0.5dBm), antenna type 5dBi (omni-directional) @ sampling rate = 10mins; Capacity of 175 nodes has been tested.
Network Data Arrival Rate	Into WISENMESHNET® greater than 99.5%
Single Node Environmental Coverage	i. Light concrete indoor environment ≥ Approx. 900 square meters ii. Underground tunnel environment ≤ Approx. ±200m (tunnel diameter = 3m, Tx, Rx antenna distance to the wall = 10cm)

4. Smart Gateway Terminologies
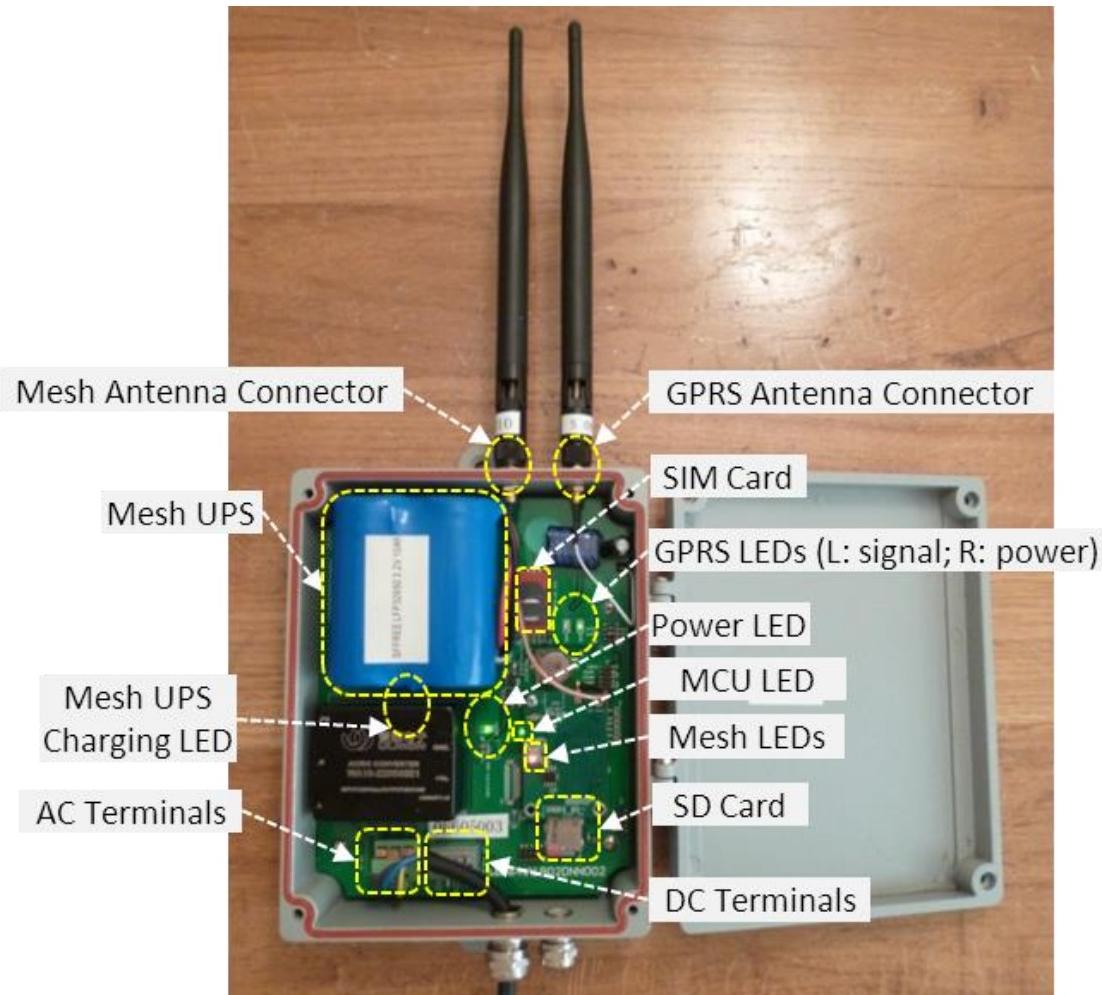
Figure 2. Smart Gateway Terminologies.

5. Operation Procedures

5.1．Smart Gateway Location Choices

Location: There are three fundamental considerations that are used by Wisen to identify available location

for a Smart Gateway:

    1)   Firstly, the mesh coverage is the primary factor to be considered. It is vital to arrange the wireless

mesh topology so that all the nodes in the system are connected. The recommended location of a Smart Gateway is in the centre of the network;

2) Secondly, GPRS coverage in the site must be available to ensure communication between a gateway and a remote server. The simplest way to check the signal availability on site will be to use a mobile phone having the same service operator as that of the Smart Gateway;

3) Thirdly, the power cable length, which relates to the cost of deployment or the DC power source availability.

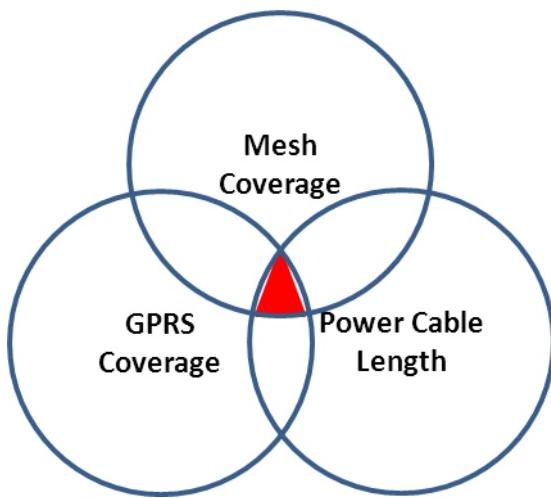Once the location is chosen, you are ready to deploy your WISENMESHNET system.

Figure 3. Smart Gateway Location Factors.

5.2．Deployment Procedures

1) Open the box: Take the Smart Gateway out of the package, open its lid;

2) SIM Card Installation: A Smart Gateway contains a 4-channel GPRS (850/900/1800/1900MHz）modem, which can be used globally. In the UK, it has been fully tested with Vodafone. While in China, it has been fully tested with China-Mobile and China-Unicom service providers. If you are in any other country, please consult with our Wisen engineers for the required changes;

   A. As shown in the figure below, insert the SIM into the plastic holder so the metal contacts are facing the shield, with the notch of the card at the top of the bracket;

   B. Slide the SIM all the way into the bracket;

C. Push the SIM to the board and slide the metal bracket towards the edge of the shield to lock it in place.

Figure 4. SIM Card Insertion.

Warning: To insert/replace the SIM card, you MUST:

a) Turn off both the mains AC and the DC power supply;

b) Make sure the GPRS LEDs are completely off.

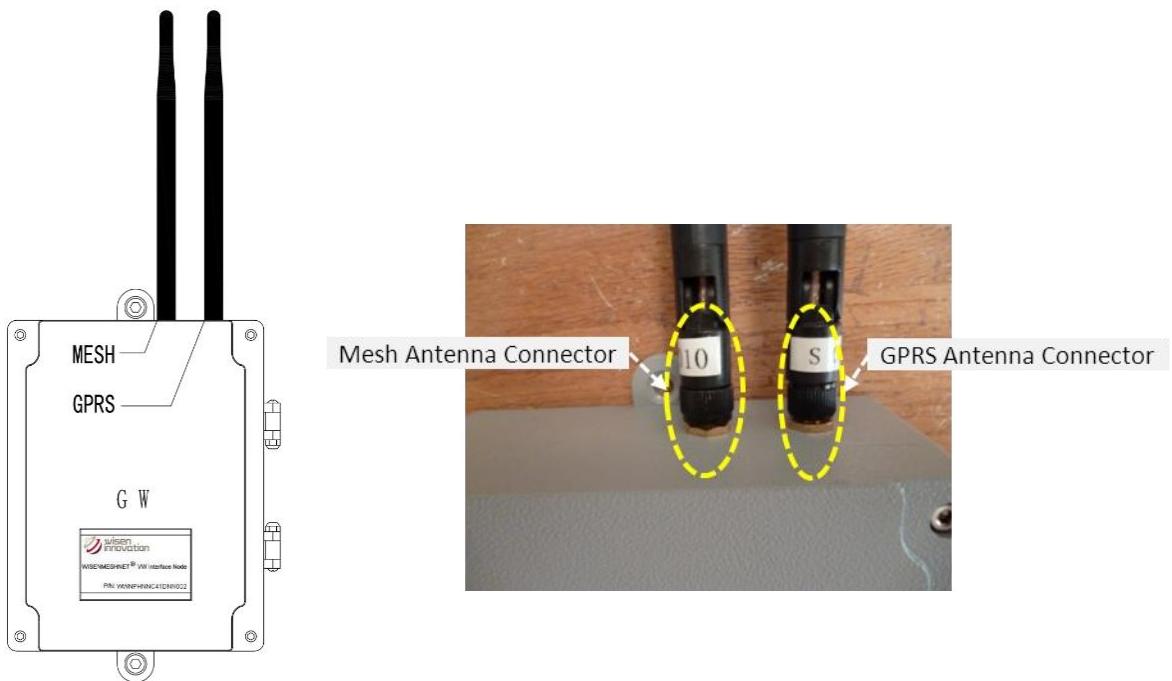3) Antenna Installation: screw the antennas tightly onto the Smart Gateway.

Figure 5. Mesh Antenna and GPRS Antenna.

4) Power on: by default, an AC plug has been connected on a Smart Gateway. However, before either the AC or the DC power is applied, please use a Multi-meter to check that the power supply voltage is suitable, as defined in the Feature table.

Please follow the figure below to make the AC and the DC power connections:

A.   Unscrew the cable gland cover;

B.   Insert the cable through the cover and into the gland;

C.   Before any power cable is connected, ensure the AC supply is 100-240VAC and the DC supply is 9-12VDC by using a Multimeter. Note the DC power supply must be able to provide at least 2A current;

D.   Notice🟠 that gland EMC-CMA14 (the 14mm gland on the left) is used for the AC cable, which then is connected to the GREEN WAGO internal terminal plugs, where "L" – Live; "N" – Negative; "FG" – Ground;

E.   Notice🟠 that gland EMC-CMA12 (the 12mm gland on the right) is used for the DC cable, which then is connected to the GREY WAGO internal terminal plugs, where "DC+" and "-" are used for DC power supply; "SO+" and "–" are used for Solar power inputs [Notice🟠: 9DVC is recommended];

a)   Warning: incorrect power connection will cause serious damage.

b)   Warning: once the power cable(s) is connected, the gland cover must be firmly screwed to ensure the IP rating.
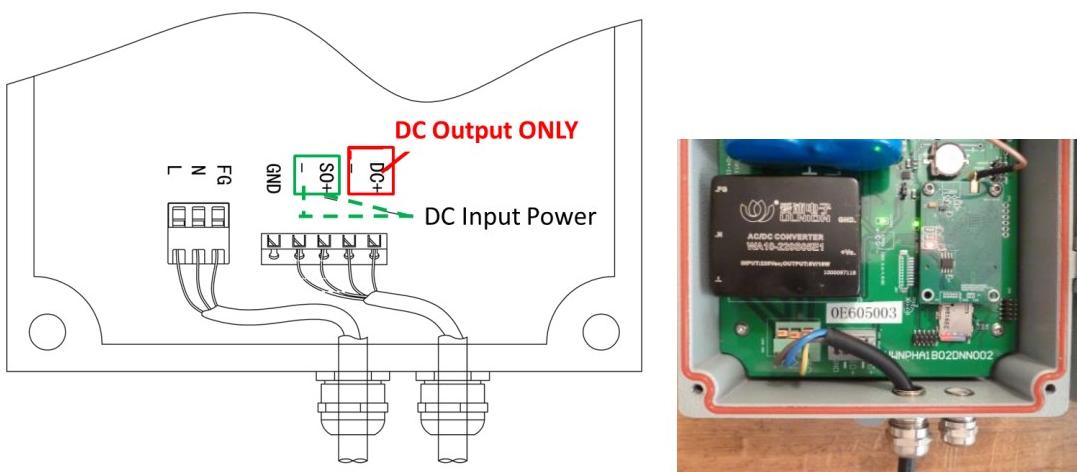

Figure 6. Left: AC and DC Cable Connections; Right: AC Cable Connection.

5)   GPRS Signal Check: By default, the Smart Gateway has already been configured and tested to send its received mesh data to a Wisen server, where we provide further services to our customers. Once the power is on, the green Power GPRS LED on the right is constantly lit while the Status GPRS LED on the

left will show the sequence referred in Section.3., "Smart Gateway LED status":

 i)   Flashing once every 1s – network registering;

 ii) Flashing once every 3s – network connected;

 iii) Both the LEDs are off – restarting.

6) System LED Status:

Terminology	Working Status	Otherwise
Power LED	Constantly ON	Check the power supplies connections
GPRS Power LED	Constantly ON	Contact with Wisen
UPS Charging LED	If ON, then recharging in progress	battery full or not recharging
MCU LED	Constantly ON	Contact with Wisen
GPRS Status LED	Flashing at 3s	Otherwise – please check if you are using the recommended GPRS service operator
	Flashing at 1s - registration	

Table 1. System LEDs Status.

MESH LED				
LED/Status	**Triggering**	**Waiting**	**Sampling**	**Receiving**
- Red LED	ON	OFF	ON	ON
- Yellow LED	ON	OFF	OFF	Flashing Once
- Green LED	ON	ON	ON	OFF

Table 2. Mesh LED Status.

7) To validate the sensor data, and to see if it works, please refer to << WISENMESHNET® System Evaluation User Guide >>.

5.3．Smart Gateway Mounting Options

Depending on the installation surface, the Smart Gateway can be deployed using three different methods:

1）Flat Surface Fixing using Two Din Rails

Step 1: Cap-Hex-Head Screw M6x14 (Qty. 4) – firmly screw two Din Rails to the back of the Smart

Gateway box;

Step 2: Anchor Bolt M6x70 (Qty. 4) (Drill size of M10) – firmly bolt the two din rails onto the flat
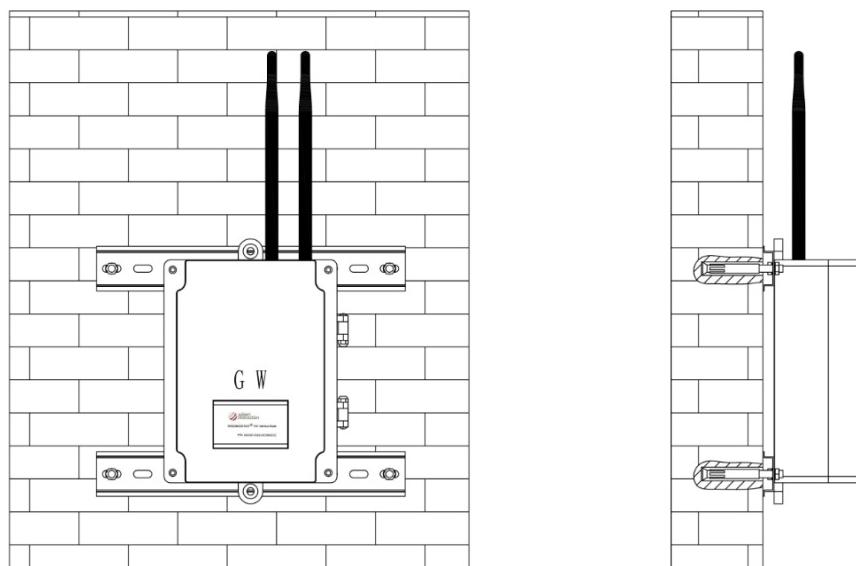
surface.

Figure 7. Smart Gateway - Two Din Rails Fixing.

2）Flat Surface Fixing using One Din Rail

Step 1: Cap-Hex-Head Screw M6x14 (Qty. 2) – firmly screw one Din Rail to the back of the Smart

Gateway box;

Step 2: Anchor Bolt M6x70 (Qty. 2) (Drill size of M10) – firmly bolt one Din rail onto the flat surface.
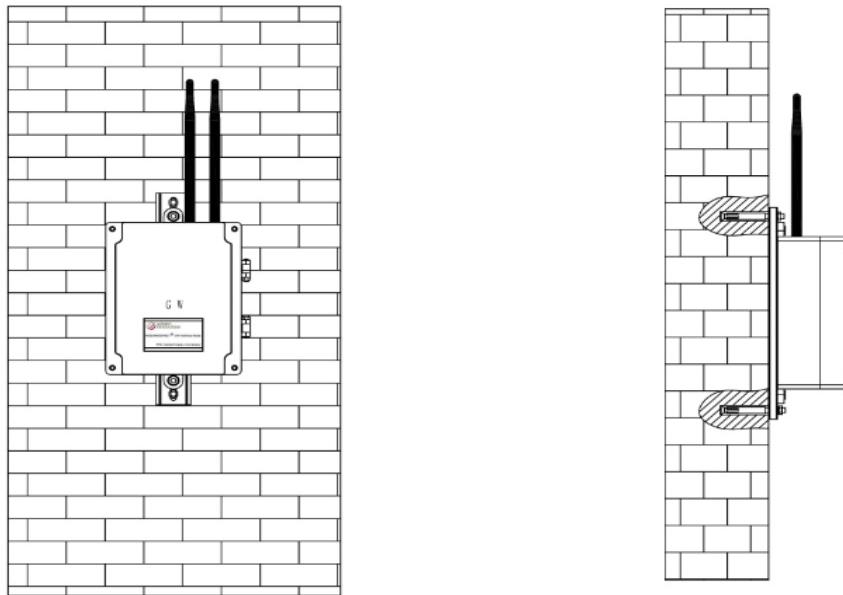
Figure 8. Smart Gateway - One Din Rail Fixing.

3）Column Fixing using Releasable Cable Ties

Step 1: Cap-Hex-Head Screw M6x14 (Qty. 2) – firmly screw one Din Rail to the back of the Smart Gateway box;

Step 2: Metal Releasable Cable Tie (Qty. 2 minimum) – thread cable tie through the Din Rail slots or through the gap between the Din Rail and the back of the Smart Gateway box, then tighten the cable ties around the column.

Figure 9. Smart Gateway - Cable Tie.

Notice⚠️:

1) When the deployment is complete, please ensure that at least one/both of AC and DC power supplies are turned on and the cable glands are tightened. Any unused gland should be sealed properly to maintain the IP rating of the box;

2) The Mesh backup UPS battery must be connected;

3) The GPRS Link LED should be flashing once every 3s;

4) Ensure that data is seen from the remote server;

5) Tighten the 4 Cap-Hex-Head screws on Gateway lid.

6. General Maintenance and Notification

1) Once the WISENMESHNET® Smart Gateway is installed and working, please do not interfere with it unless it is absolutely necessary;

2) The Smart Gateway relies on radio signals to communicate with the nodes. It must be deployed before the nodes and please ensure that it is not covered by any materials, which would block the radio signals, for example, chicken wire, aluminum sheet hoardings, etc.;

3) Please make sure the correct power voltage is supplied;

4) If no data is received from the Smart Gateway, then please carry out investigations in the following two stages:

    A. Remote Inspection of historical data, to identify:

        a) Whether the heart-beat message has been sent back successfully at each time interval;

        b) Whether the power supply voltage in the heart-beat message is as expected, if not, please check the power connection;

        c) Whether the signal strength has become significantly weaker, if yes, please check the antenna has been screwed on firmly;

        d) Whether the SIM card contract is valid and that payment is up to date.

B.   On-site Inspection: if all above are good, please arrange for an on-site inspection to check:

   a)   Whether the Serial Gateway has visible external damage;

   b)   Please check that the GPRS and Mesh antennas have not been swapped to the wrong connectors;

   c)   Whether the antenna is bent or damaged and the node (gateway or sensor node) is not blocked by new construction, e.g., hoardings.

   d)   When it is possible, check that the signal strength is normal by using a spectrum analyser;

   e)   Use a multimeter to check the AC power of 100 – 240VAC or the DC power of 9‑12VDC;

   f)   Whether any interface connectors are loose.

Notices⚠️:

i.   Case One: If any change has been made from the list above, please inspect the data from the remote server;

ii.   Case Two: If all the actions from the list above have not cured the problem, please contact Wisen. We will be happy to help.

7. Package Information

Standard:

No.	Items	mm	Qty.
1	WISENMESHNET® Smart Gateway	200x150x55	1
2	User Manual	-	1
3	Inspection Report	-	1
4	2.4GHz 5dBi Omni-directional Antenna	200	1
5	GPRS Antenna	200	1
6	Din Rail	250x35	2
7	Cap-Hex-Head Screw	M6x14	4
8	Anchor Bolt	M6x70	4

Optional/Customer Preparation:

No.	Items	Purpose
1	M6 Anchor Bolt Spanner	Bolts to the mounting surface
2	M6 Cap-Hex-Head Screwdriver	Screws between din rail and the back of the node box
3	M3 Cap-Hex-Head Screwdriver	Screws on the lid
4	Metal Cable Tie	For special mounting
5	Power Cable Gland Spanner	Tighten the cable for its IP rating

8. Safety and Warning

Warning: Please read the following instructions carefully.

1）Operation Safety

➢ Before taking any action, please read all the information provided carefully, and keep the guidance documents safe;

➢ Ensure that any procedure and installation are correctly carried out. The communication cable and the case must be grounded.

➢ This product has been designed to a certain water-proof level. However, it becomes water vulnerable when the lid is open or if the cable gland has not been sealed properly.

2）Electric Safety

➢ The Smart Gateway plays a crucial part in WISENMESHNET system. Please ensure that reliable power is supplied; Please strictly follow the power connection instructions and ensure that all connections are made correctly;

➢ Please make sure that the FG terminal on the AC power supply is connected to the ground properly; if not sure, please check using a multimeter, otherwise unexpected damage or injury may occur.

3）Warning

➢ This product must not be disassembled under any circumstances, to do so will void the warranty and may leave the product in a dangerous state;

➢ If all the above are not followed, the manufacturer cannot be held responsible for any damage and injury caused to the users.

4）Caution

➢ Danger of explosion if battery is incorrectly replaced. Replace only with the type recommended by the manufacturer.

➢ When disposing of the batteries, please contact your local authorities or dealer and ask for the correct method of disposal.

9. Contact

- Wisen Innovation Ltd: www.wiseninnovation.co.uk

- Email: enquiries@wiseninnovation.co.uk

10. Appendix – New Gateway Layout
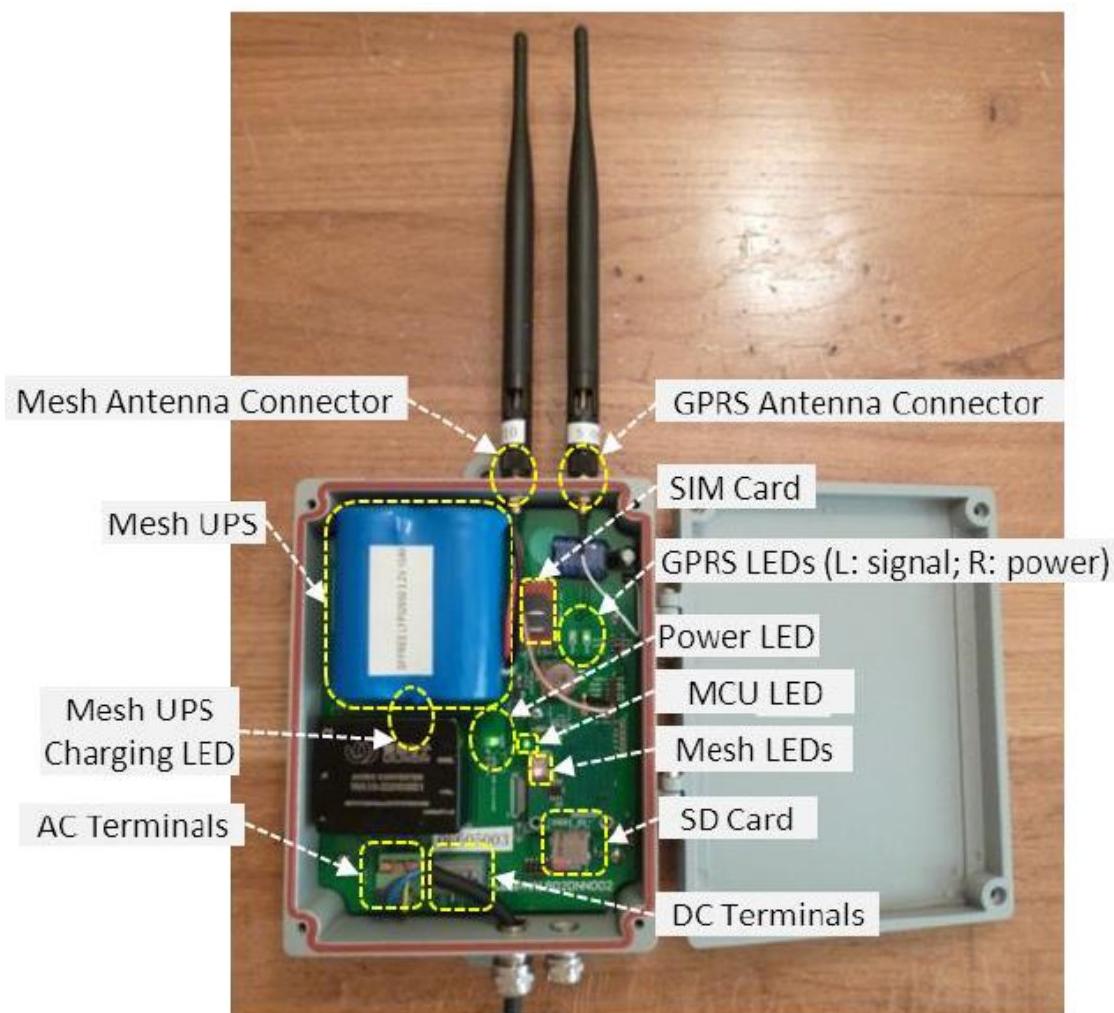
Version One: Gateway Layout (Released before 2015), Please refer to Version Two

Gateway Layout as below.

MESH Antenna Connector

GPRS Antenna Connector

UPS Charge LED

SIM Card

GPRS LEDs (L: connected; M: registering; R: power on)

MESH UPS Battery

GPRS Selection Jumper

RS232 Selection Jumper

Mesh LEDs

232TX/RXGND Output

Power LED

Gateway LED

Micro SD Card

AC Input Terminal

DC Input Terminal

Version Two: Gateway Layout (Released after 2015).